NIPPON PRECISION CIRCUITS INC.

CF5012 series

Low-current Consumption Crystal Oscillator Module ICs

OVERVIEW

The CF5012 series are low-current consumption 3rd-harmonic crystal oscillator module ICs. Internal circuit optimization means these devices have reduced current consumption in comparison with our existing 3rd-harmonic oscillator devices. The crystal oscillator circuit has a built-in thin-film feedback resistor with good temperature characteristics and built-in capacitors with excellent frequency response, resulting in a stable 3rd-order overtone oscillator with only the connection of a crystal element.

FEATURES

- 3rd-harmonic oscillation
- 2.7 to 3.6V operating supply voltage range
- 30 to 45MHz recommended operating frequency range
- Inverter amplifier feedback resistor built-in
- Oscillator capacitors C_G , C_D built-in
- Output three-state function (high impedance in standby mode)
- f_O output frequency (oscillator frequency)
- 8mA output drive capability (V_{DD} = 2.7V)
- 6.5mA (typ) low current consumption (V_{DD} = 3V, C_L = 15pF, f = 40MHz)
- CMOS output duty level
- Chip form (CF5012×××)

SERIES CONFIGURATION

Version	Recommended operating frequency [MHz]	gm ratio	Built-in capacitance [pF]		R_f [kΩ]
			C_G	C_D	
CF5012ANB	30 to 45	1.0	8	15	3.1

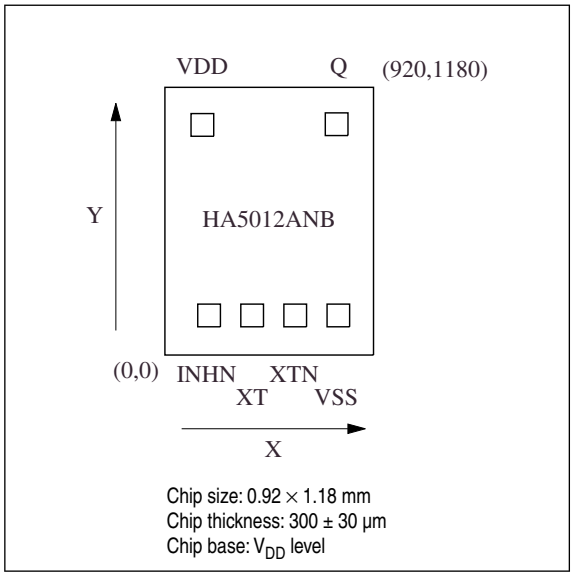
Note: Recommended operating frequency is not the guaranteed value but is measured using NPC's standard crystal.

ORDERING INFORMATION

Device	Package
CF5012×××–1	Chip form

PAD LAYOUT

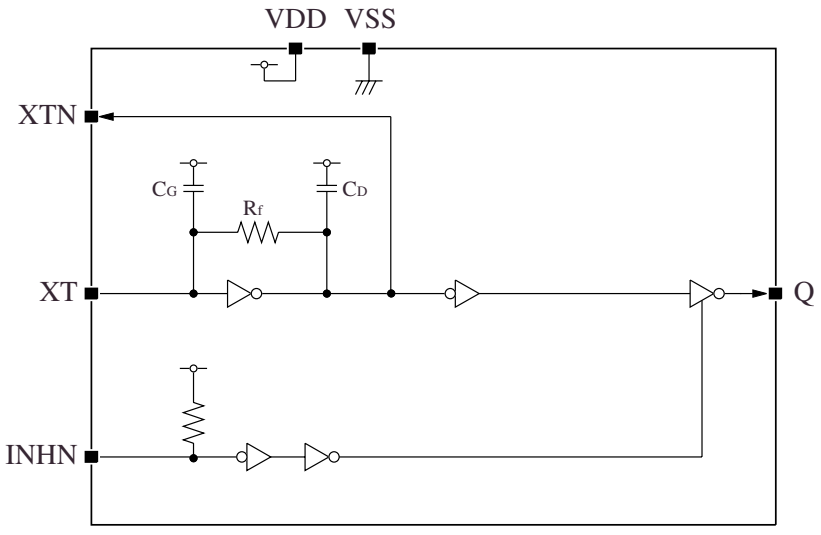
(Unit:µm)



PIN DESCRIPTION and PAD DIMENSIONS

Name	I/O	Description		Pad dimensions [µm]	
				X	Y
INHN	I	Output state control input. High impedance when LOW. Pull-up resistor built in		195	174.4
XT	I	Amplifier input	Crystal oscillator connection pins. Crystal oscillator connected between XT and XTN	385	174.4
XTN	O	Amplifier output		575	174.4
VSS	–	Ground		765	174.4
Q	O	Output. Output frequency. High impedance in standby mode		757.6	1017.6
VDD	–	Supply voltage		165.4	1014.6

BLOCK DIAGRAM



Substrate potential: V_{DD}

SPECIFICATIONS

Absolute Maximum Ratings

V_{SS} = 0V

Parameter	Symbol	Condition	Rating	Unit
Supply voltage range	V_{DD}		–0.5 to +7.0	V
Input voltage range	V_{IN}		–0.5 to V_{DD} + 0.5	V
Output voltage range	V_{OUT}		–0.5 to V_{DD} + 0.5	V
Operating temperature range	T_{opr}		–40 to +85	°C
Storage temperature range	T_{stg}		–65 to +150	°C
Output current	I_{OUT}		25	mA

Recommended Operating Conditions

V_{SS} = 0V, f ≤ 45MHz, C_L = 15pF unless otherwise noted.

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Supply voltage	V_{DD}		2.7	–	3.6	V
Input voltage	V_{IN}		V_{SS}	–	V_{DD}	V
Operating temperature	T_{OPR}		–20	–	+80	°C

Electrical Characteristics

V_{DD} = 2.7 to 3.6V, V_{SS} = 0V, Ta = –20 to +80°C unless otherwise noted.

Parameter	Symbol	Condition		Rating			Unit
				min	typ	max	
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, V_{DD} = 2.7V, I_{OH} = 8mA		2.2	2.4	–	V
LOW-level output voltage	V_{OL}	Q: Measurement cct 2, V_{DD} = 2.7V, I_{OL} = 8mA		–	0.3	0.4	V
Output leakage current	I_Z	Q: Measurement cct 2, INHN = LOW, V_{DD} = 3.6V	V_{OH} = V_{DD}	–	–	10	µA
			V_{OL} = V_{SS}	–	–	10	µA
HIGH-level input voltage	V_{IH}	INHN		0.7V_{DD}	–	–	V
LOW-level input voltage	V_{IL}	INHN		–	–	0.3V_{DD}	V
Current consumption	I_{DD}	Measurement cct 3, load cct 1, INHN = open, C_L = 15pF, f = 40MHz		–	6.5	13	mA
INHN pull-up resistance	R_{UP}	Measurement cct 4		40	100	250	kΩ
Feedback resistance	R_f	Measurement cct 5		2.63	3.1	3.57	kΩ
Built-in capacitance	C_G	Design value, determined by the internal wafer pattern		7	8	9	pF
	C_D			13	15	17	pF

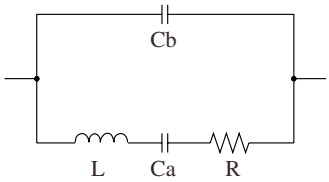
Switching Characteristics

V_{DD} = 2.7 to 3.6V, V_{SS} = 0V, Ta = –20 to +80°C unless otherwise noted.

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Output rise time	t_r	Measurement cct 3, load cct 1, 0.1V_{DD} to 0.9V_{DD} , C_L = 15pF	–	2.0	4.0	ns
Output fall time	t_f	Measurement cct 3, load cct 1, 0.9V_{DD} to 0.1V_{DD} , C_L = 15pF	–	2.0	4.0	ns
Output duty cycle[1]	Duty	Measurement cct 3, load cct 1, Ta = 25°C, V_{DD} = 3.0V, C_L = 15pF, f = 40MHz	40	–	60	%
Output disable delay time	t_{PLZ}	Measurement cct 3, load cct 1, Ta = 25°C, V_{DD} = 3.0V, C_L = 15pF	–	–	100	ns
Output enable delay time	t_{PZL}		–	–	100	ns

1. Monitored in sample lots.

Current consumption and Output waveform with NPC's standard crystal



f (MHz)	R (Ω)	L (mH)	Ca (fF)	Cb (pF)
40	20.53	11.34	1.396	3.989

FUNCTIONAL DESCRIPTION

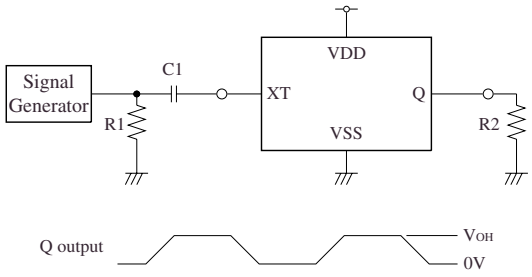
Standby Function

When INHN goes LOW, the oscillator output on Q goes high impedance.

INHN	Q	Oscillator
HIGH (or open)	f_O output frequency	Normal operation
LOW	High impedance	Normal operation

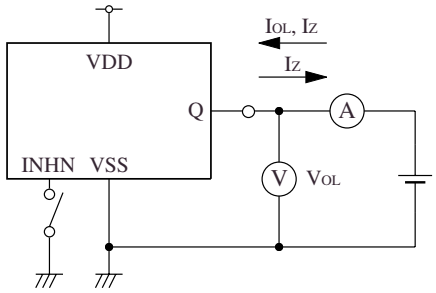
MEASUREMENT CIRCUITS

Measurement cct 1

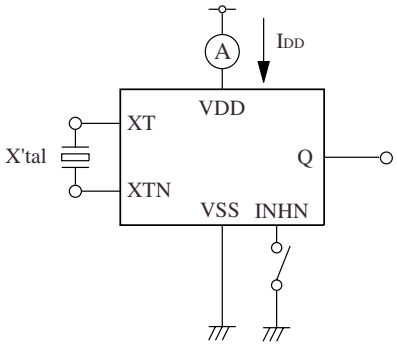


$2.0V_{P-P}$, 10MHz sine wave input signal
C1 : 0.001µF
R1 : 50Ω
R2 : 275Ω

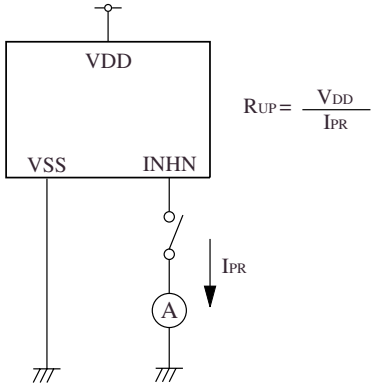
Measurement cct 2



Measurement cct 3

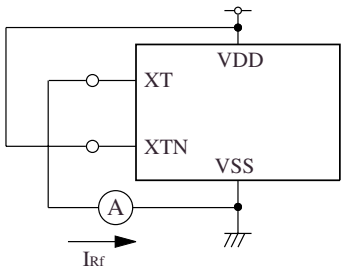


Measurement cct 4



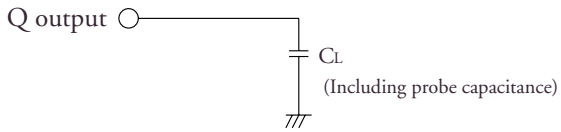
$$R_{UP} = \frac{V_{DD}}{I_{PR}}$$

Measurement cct 5



$$R_f = \frac{V_{DD}}{I_{Rf}}$$

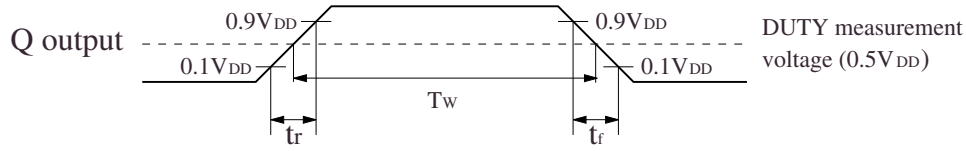
Load cct 1



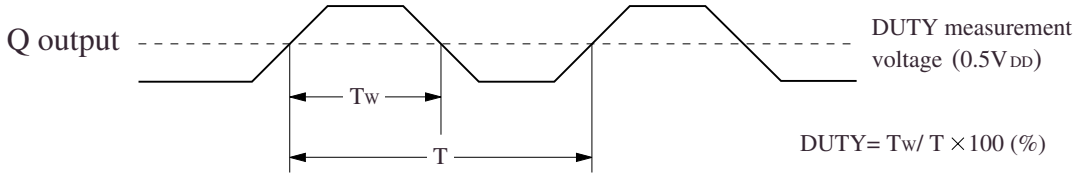
C_L = 15pF

Switching Time Measurement Waveform

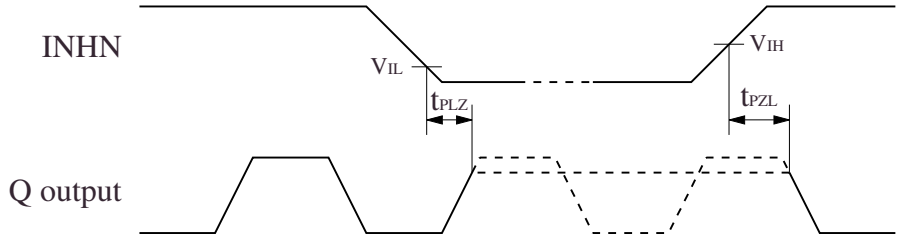
T_r , T_f , Duty



Output duty cycle



Output Enable/Disable Delay



INHN input waveform tr = tf ≤ 10ns

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